Tonkin+Taylor

Seismic-resilient landfill *'Cradle'* design

Integrating geotechnical stability and environmental protection

Daniel Tan | 2026 ALTS
Technical Director – Environmental Engineering
Tonkin + Taylor

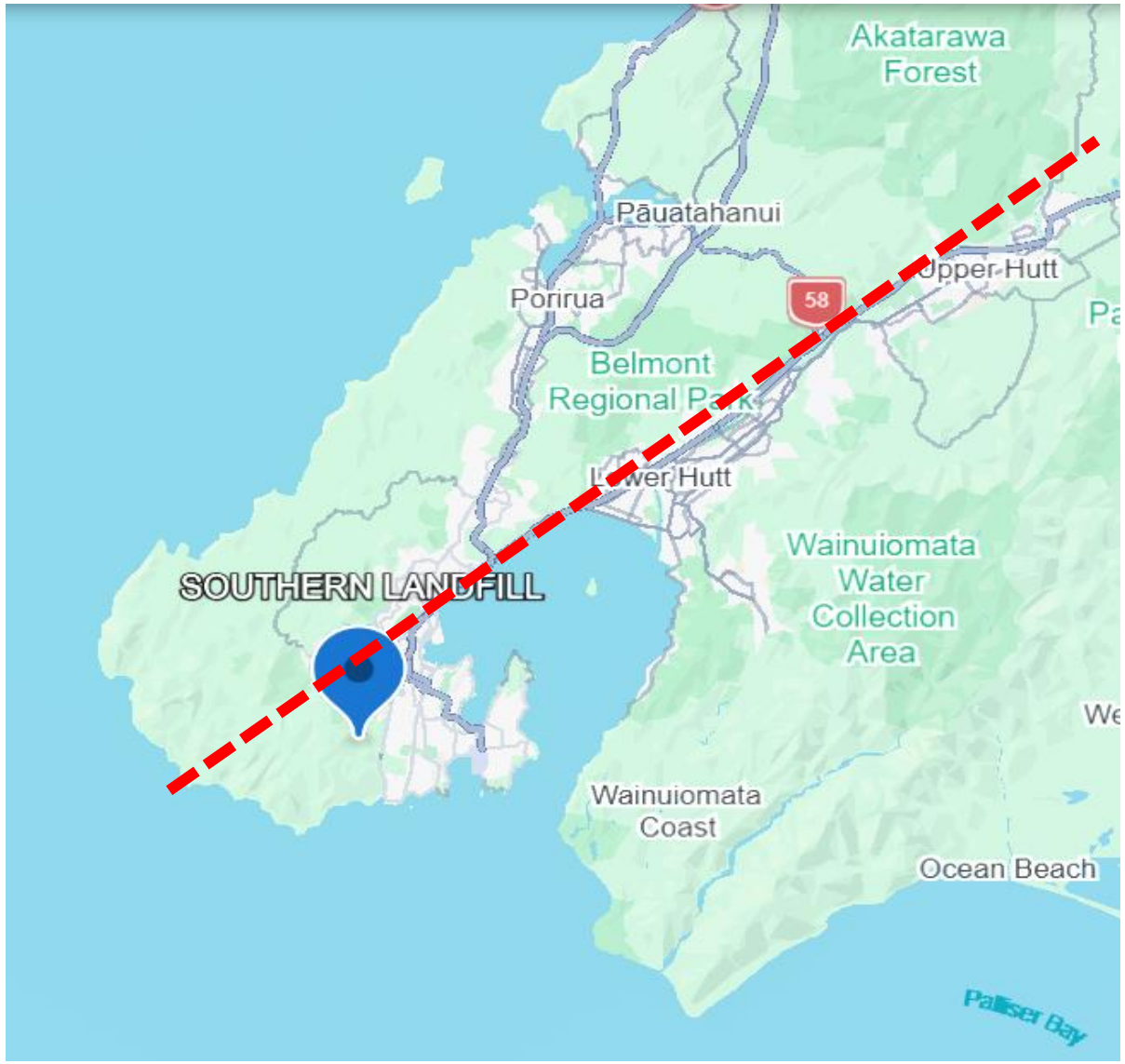


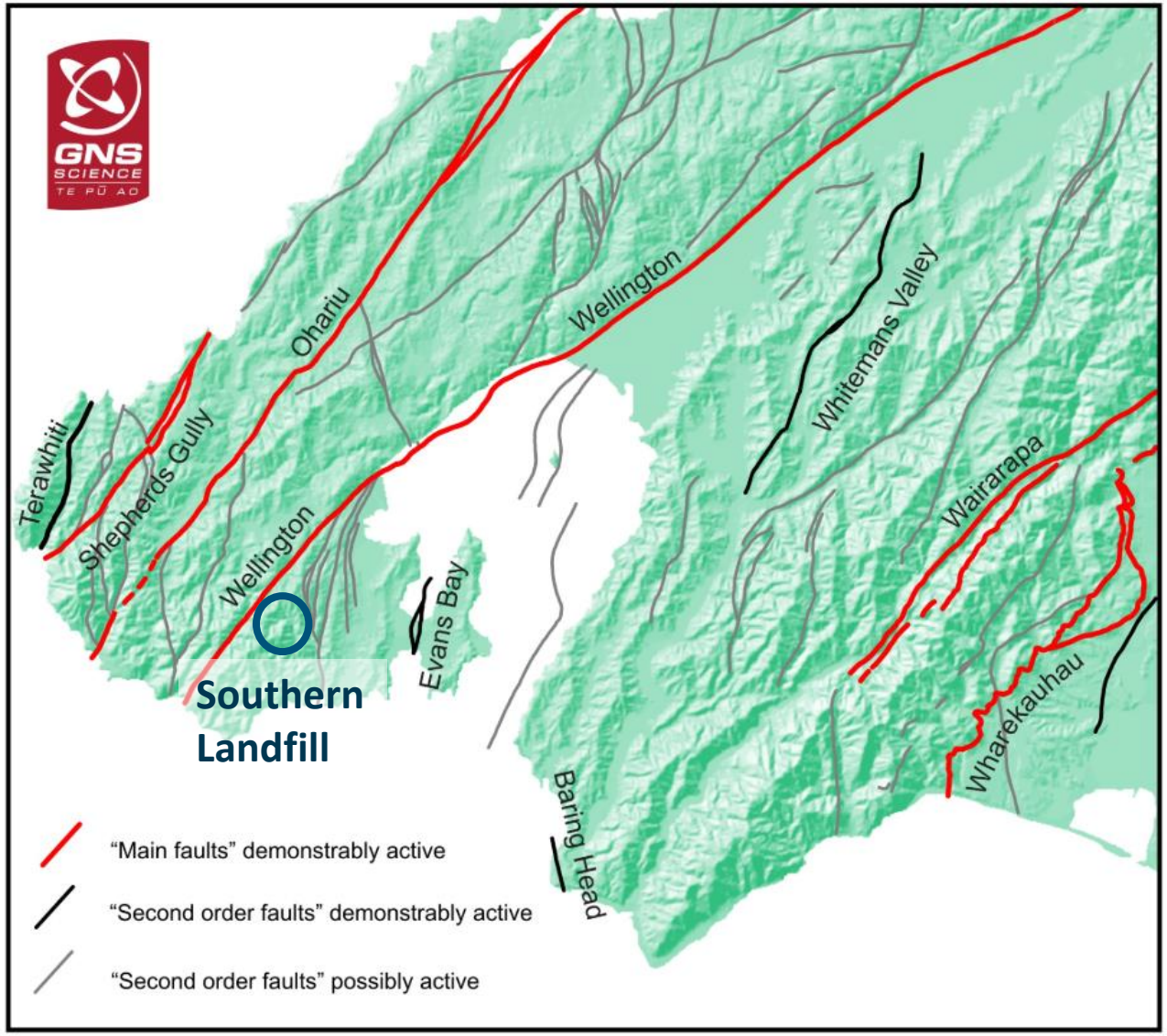

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Note: Green shows the landform only and not the final use.
Southern Landfill Extension Piggyback Option (SLEPO) Stage 1



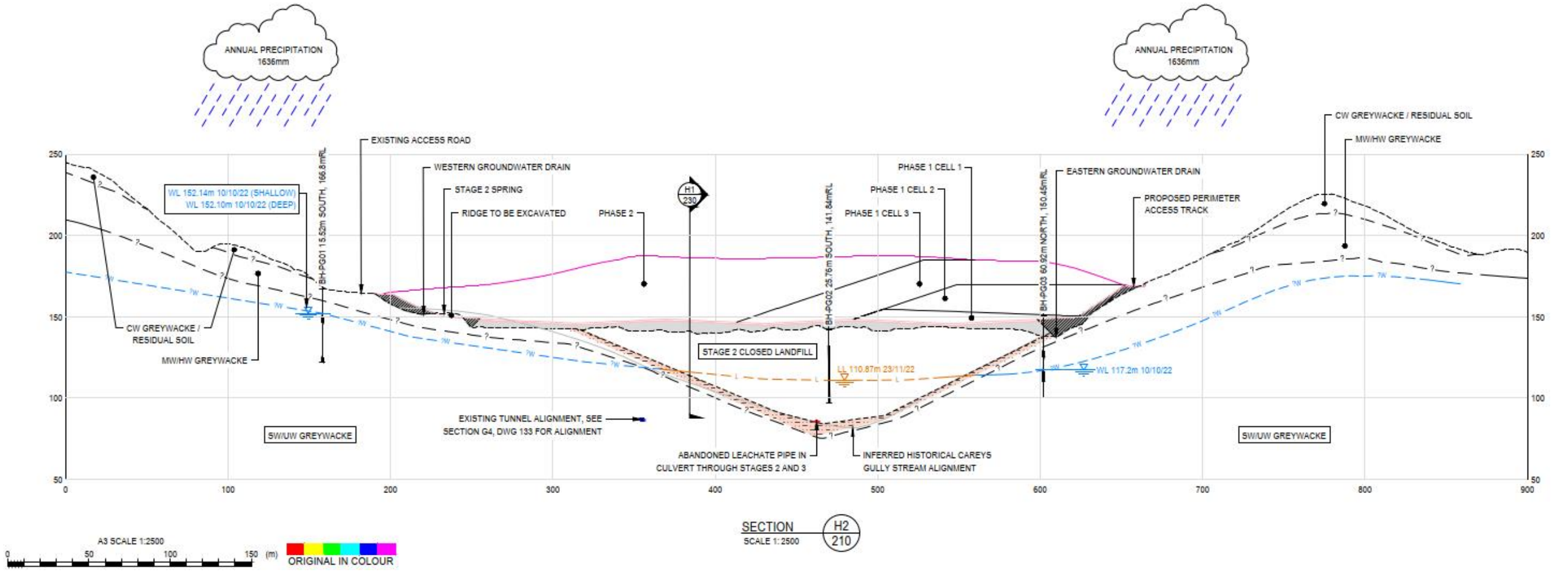
Southern Landfill Extension Piggyback Option (SLEPO) Final Landform

Engineering challenge





Engineering challenge

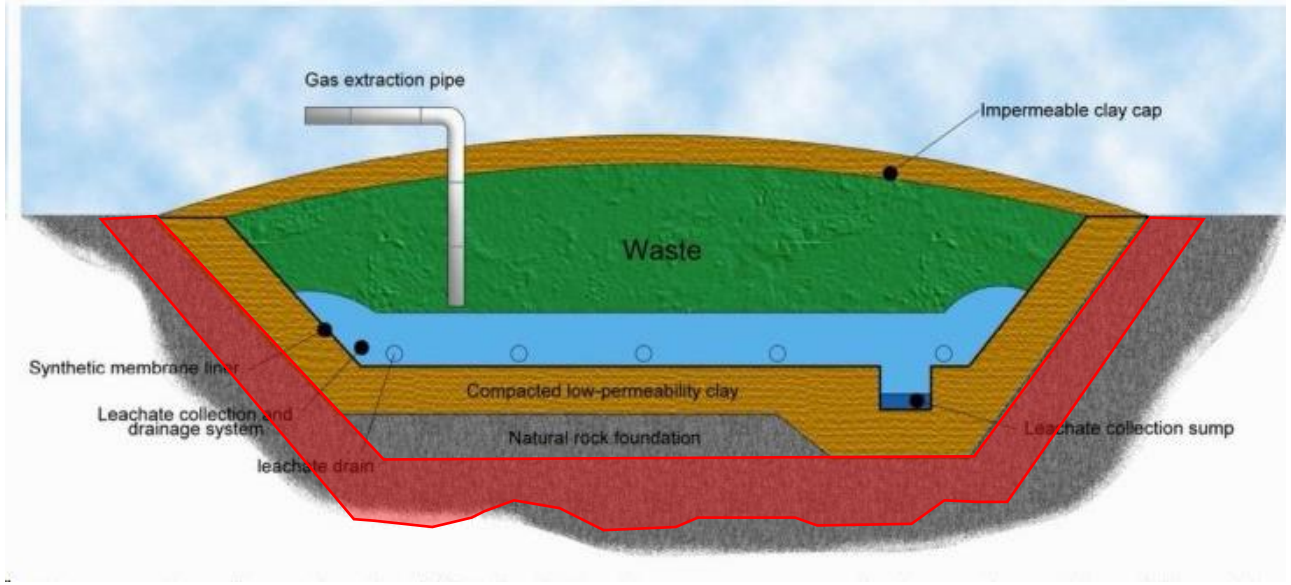


SECTION H2 210
SCALE 1:2500

A3 SCALE 1:2500
0 50 100 150 (m)
ORIGINAL IN COLOUR

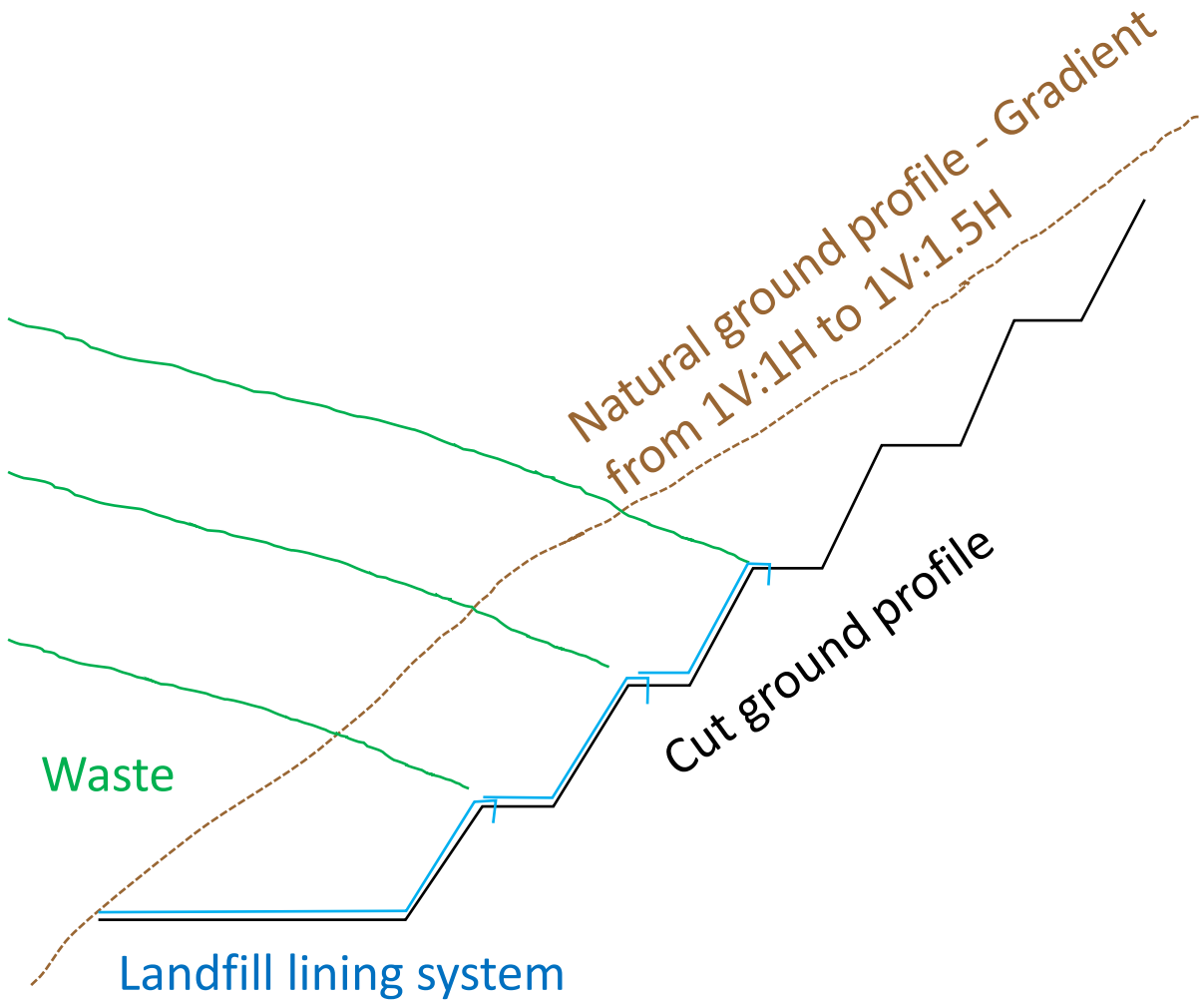
'Cradle' landfill configuration





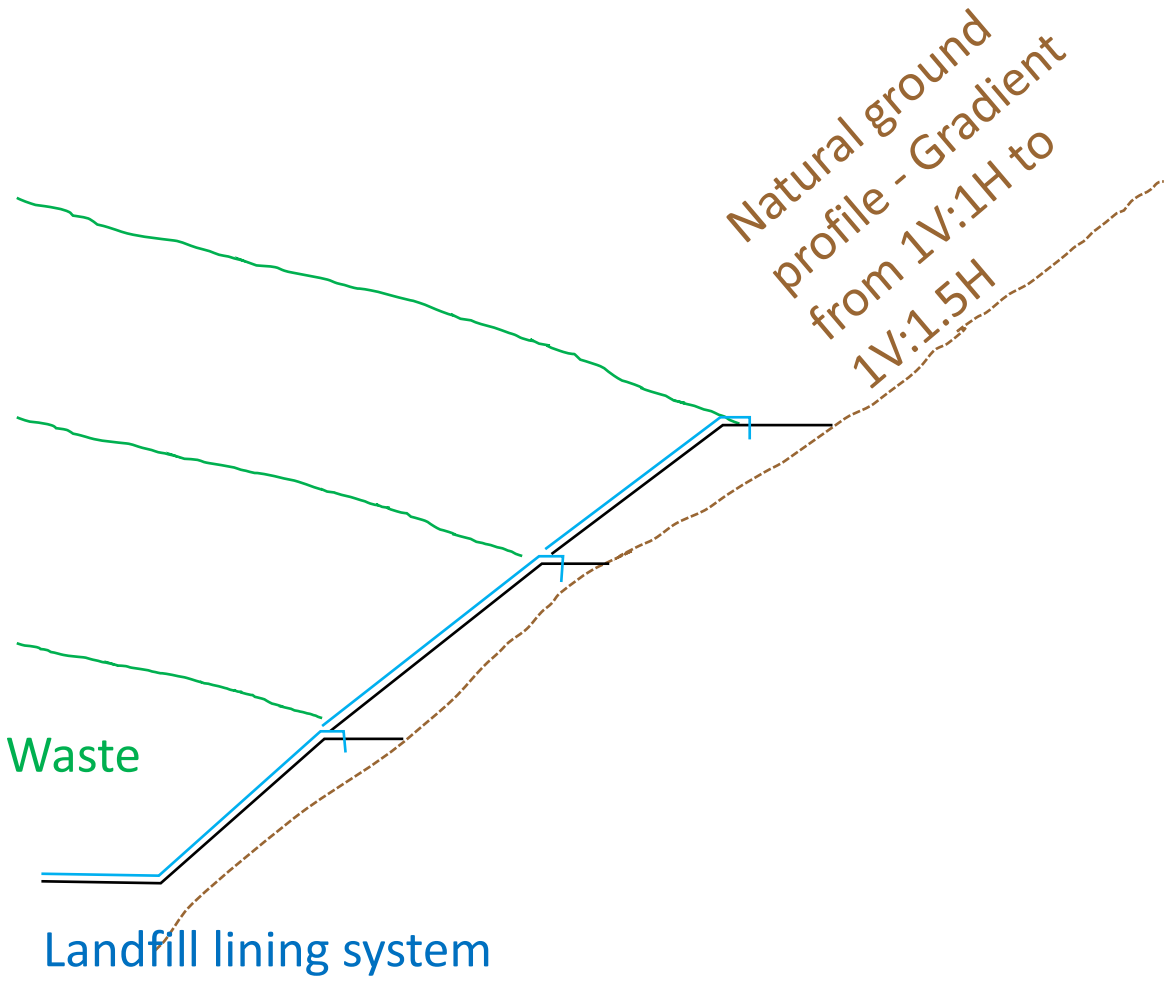
Earthworks to form basegrade

Conventional	*'Cradle'* Design
Cut to form basegrade	Fill to form basegrade
Excavation of whole slope required from top to bottom	Fill from bottom up. Does not require unnecessary vegetation clearance and exposure of soil
Fix slope and bench height is required	Slope and bench height is flexible and can be varied subject to time, air space requirement and budget
Require significant vegetation clearance and soil exposure beyond landfill footprint.	Limited vegetation clearance and soil exposure beyond landfill footprint.



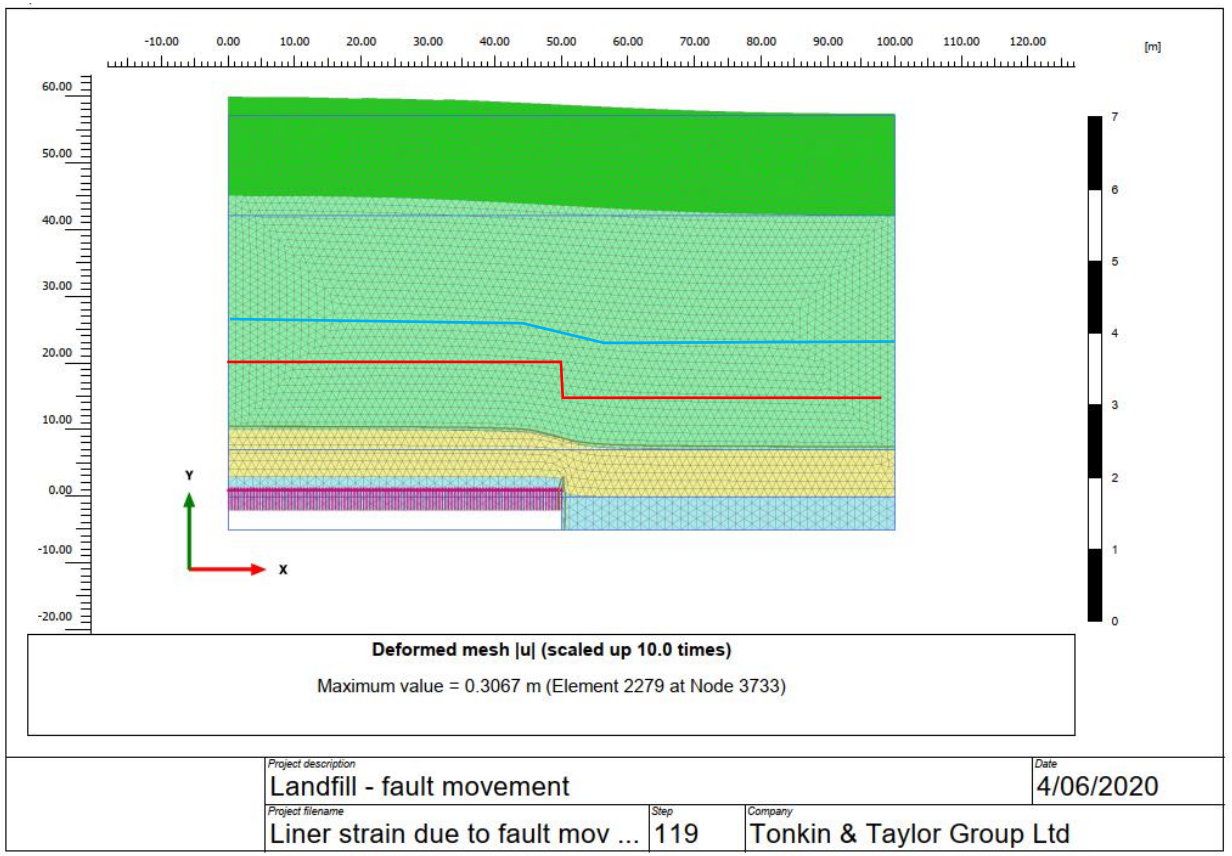
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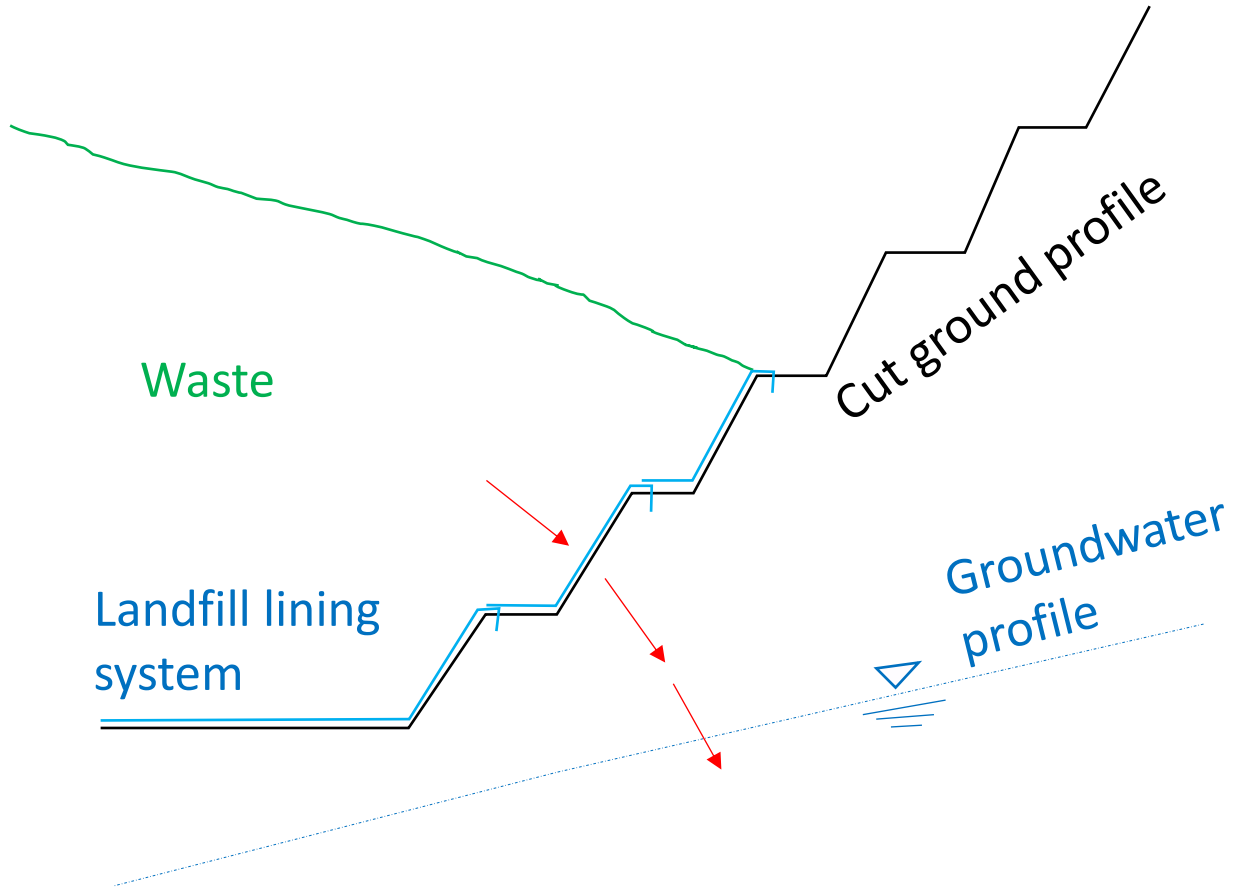
Seismic impact on the landfill lining system

Conventional	*'Cradle'* Design
Landfill lining system sits directly on natural ground	There is a soil layer between the landfill lining system and natural ground
Ground movement from secondary fault rupture or seismic shaking will have direct impact on the landfill lining system	The soil layer acts as a buffer between ground movement and reduce the impact on the landfill lining system limiting the strain on the HDPE liner to less than 3%



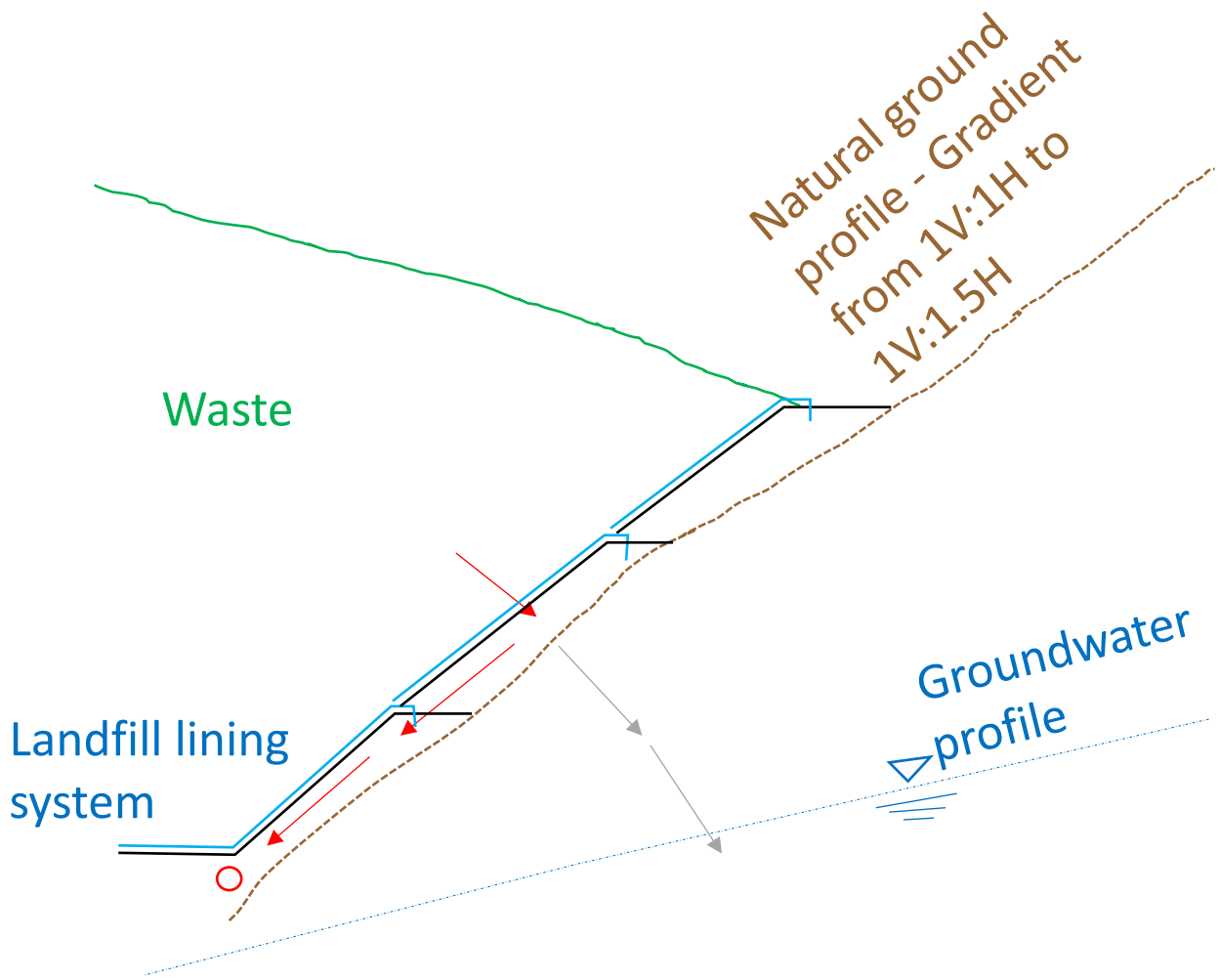
Leachate leak detection, collection & removal

Conventional	*'Cradle'* Design
Any potential leakage through the landfill lining system will come into direct contact with natural ground and subsequently groundwater	The soil layer between the landfill lining system and natural ground forms a preferential flow path for any potential leakage through the landfill lining system, making its way downslope and collected in a groundwater drainage system that doubles as a leachate leak detection, collection and removal system

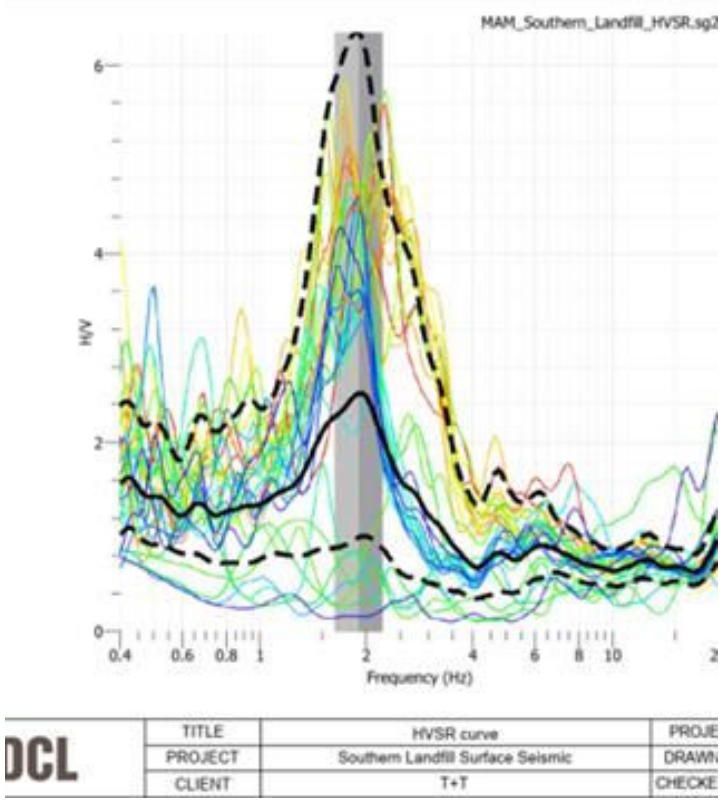


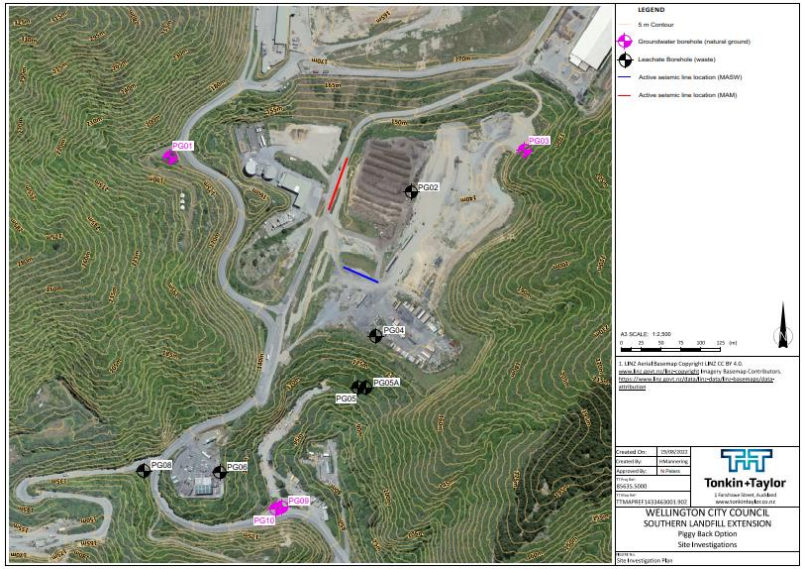
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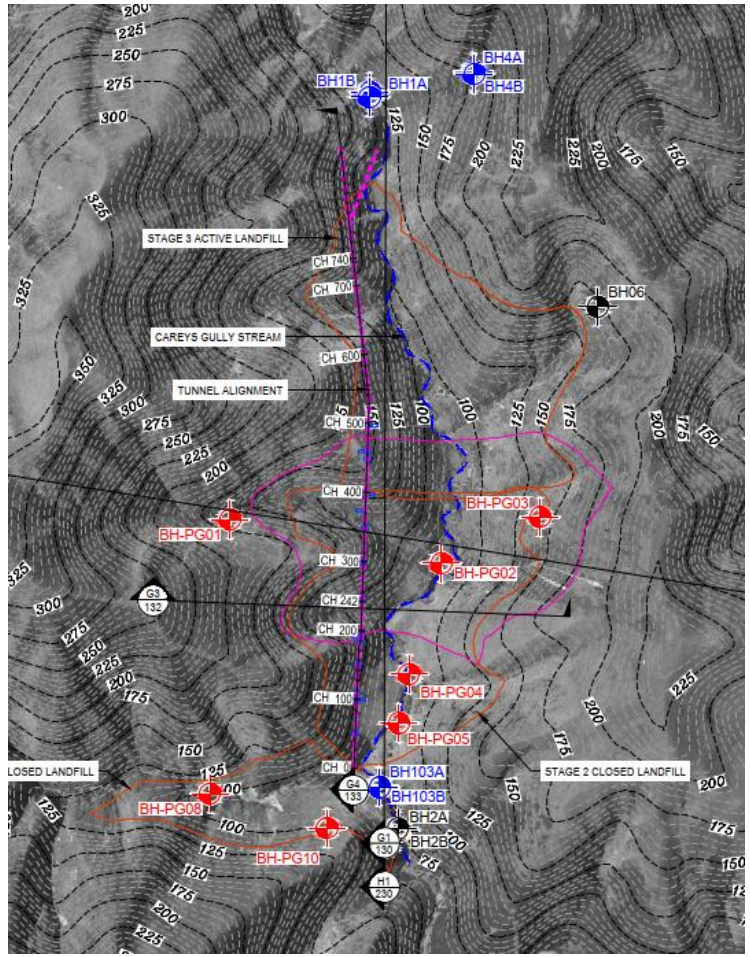
Geotechnical investigations





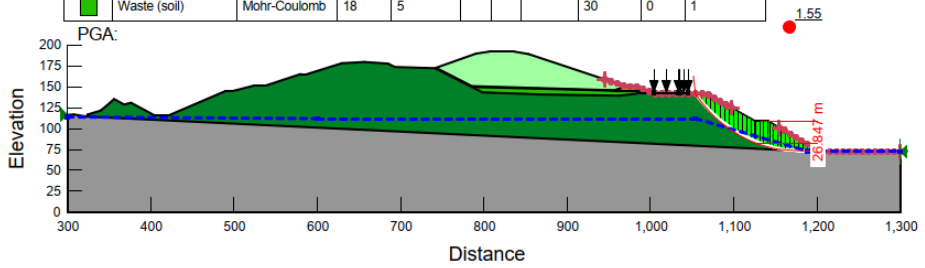


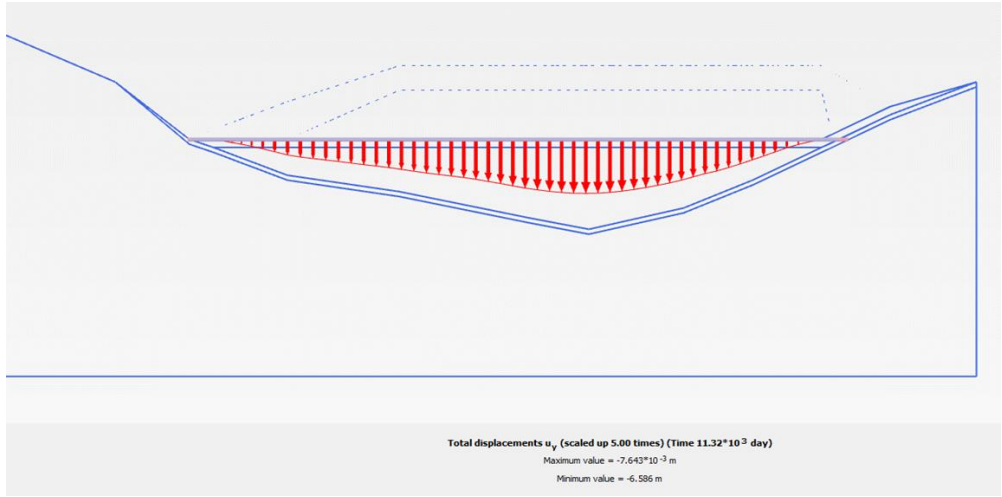
31.80-34.10m

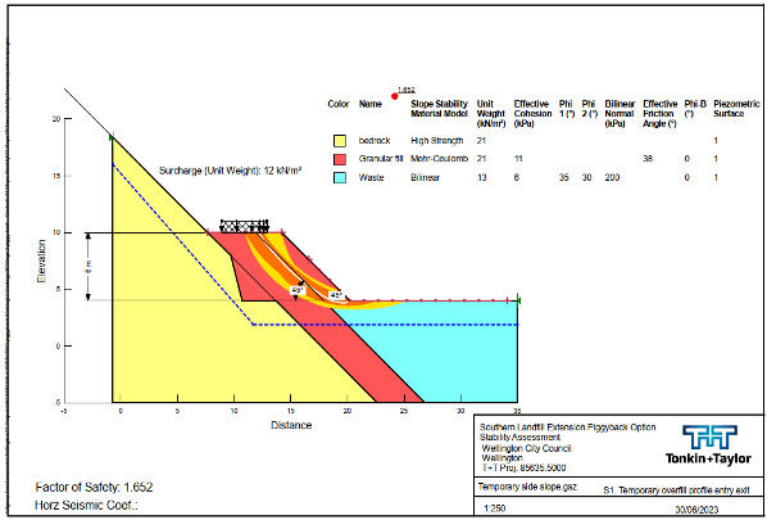


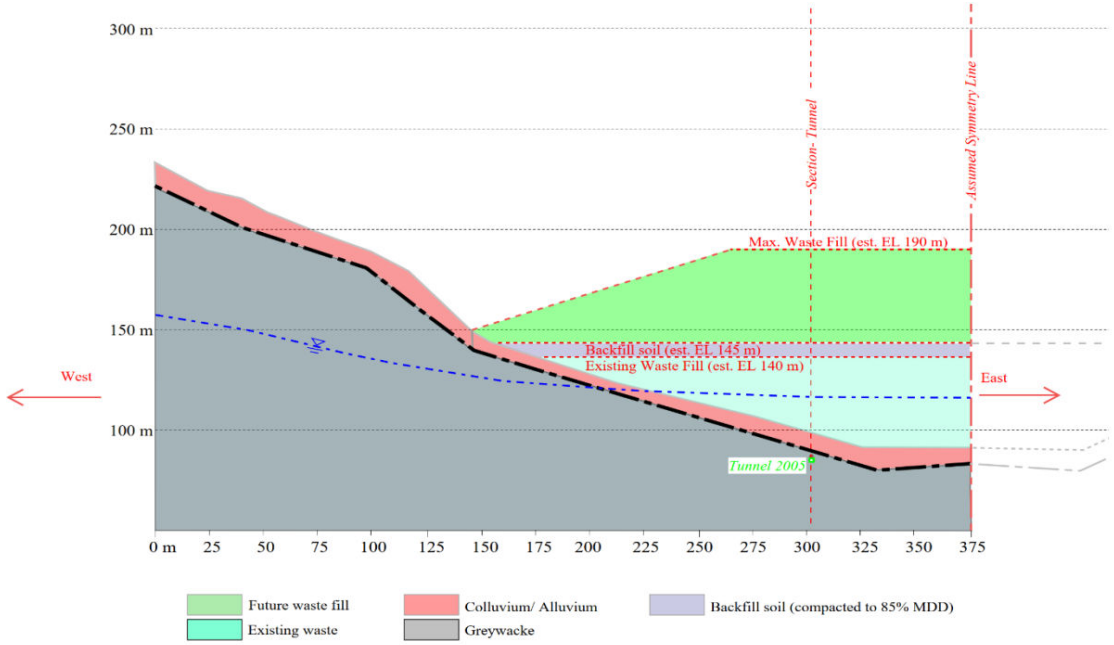
Numerical analysis

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Base liner - peak	Mohr-Coulomb	13	8				25	0	1
	Base liner - residual	Mohr-Coulomb	13	0				17	0	1
	Bedrock	Bedrock (Impenetrable)								1
	Engineered fill (new)	Mohr-Coulomb	21	11				38	0	1
	Engineered fill (old)	Mohr-Coulomb	18	1				36	0	1
	Lower (old) waste	Bilinear	13	6	35	30	200		0	1
	Waste	Bilinear	13	6	35	30	200		0	1
	Waste (soil)	Mohr-Coulomb	18	5				30	0	1

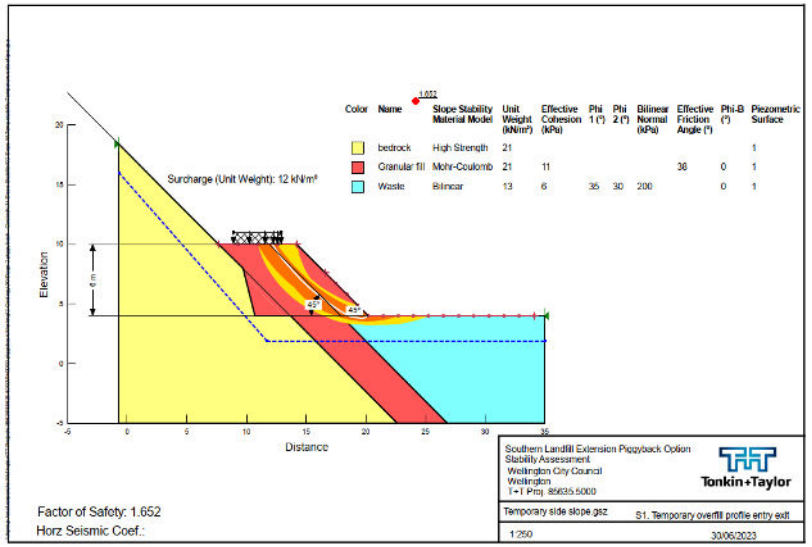




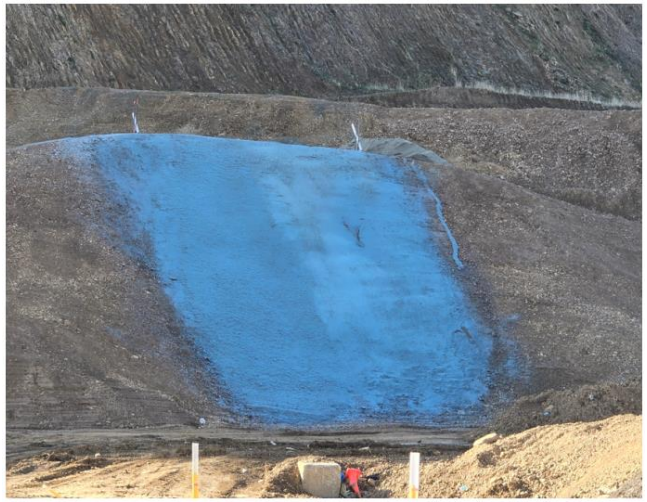




Full scale *'cradle'* field trial









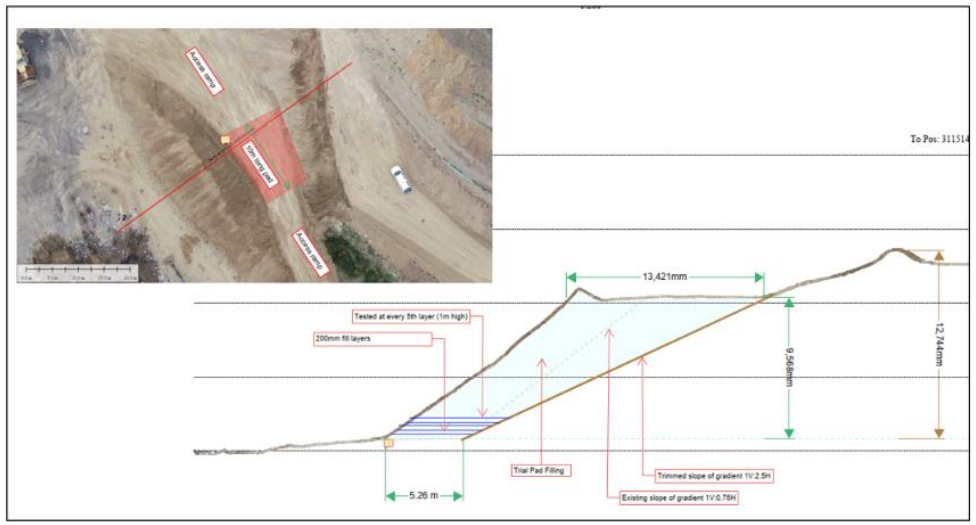


Figure 4.2: Type B sidewall liner trial construction

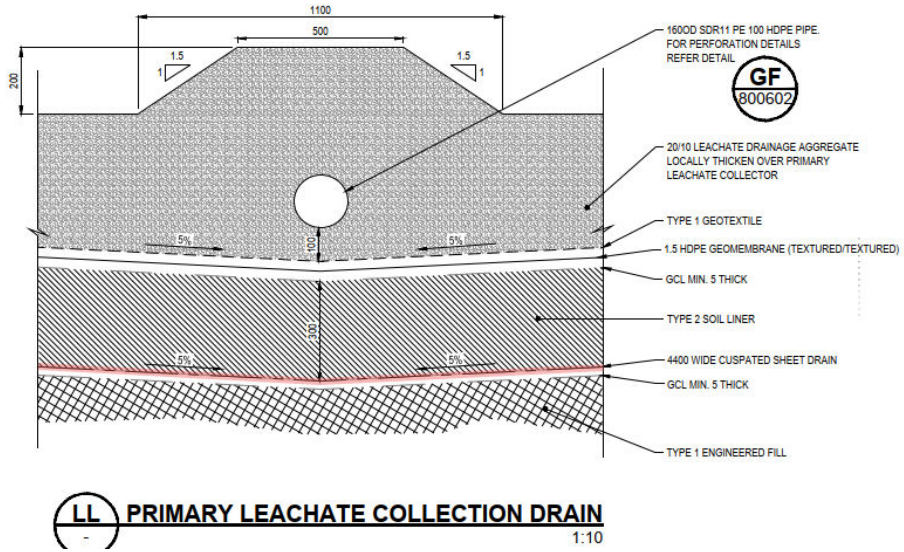
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Leachate pumping trial

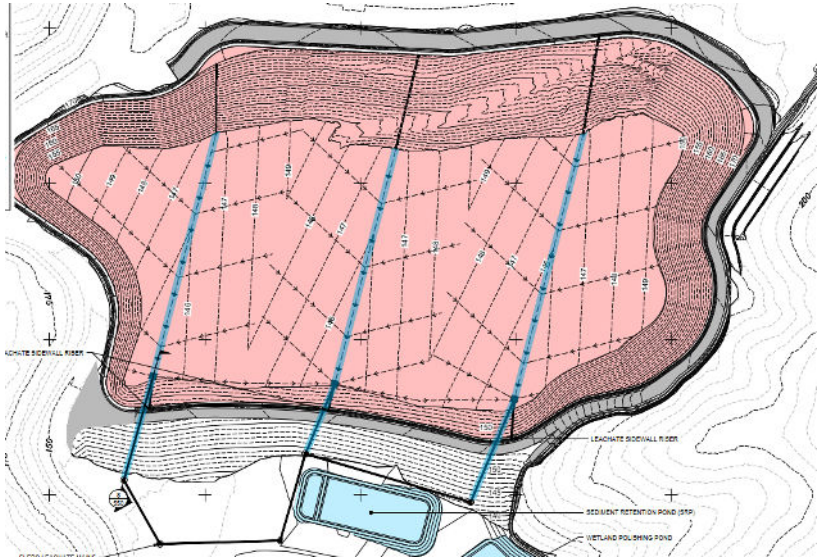
- 5 wells drilled for pumping trial
- Assess viability of leachate pumping of old / closed landfill
- Control leachate level within Stage 2 closed landfill
- Contingency plan to pump leachate if required (due to leakage or for stability requirement)
- Dual function as gas collection

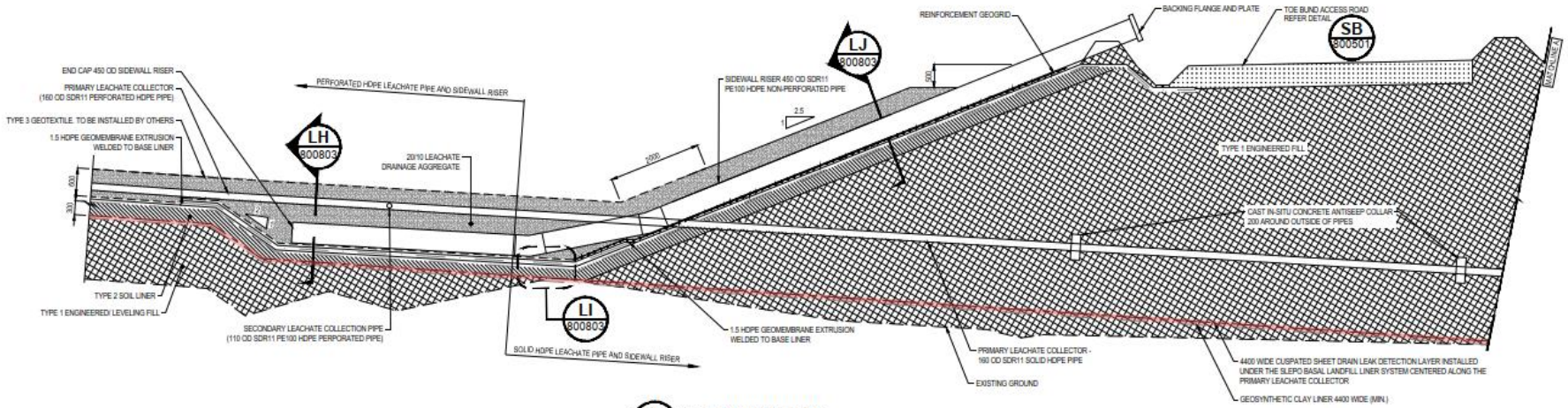


Redundancy in LCRS system



LL PRIMARY LEACHATE COLLECTION DRAIN
1:10





LE TOE BUND DETAIL
1:50

Construction of SLEPO



Construction of SLEPO





Construction of SLEPO





Construction of SLEPO





Acknowledgement

Absolutely Positively **Wellington** City Council

Me Heke Ki Pōneke



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